DOCUMENT RESUME

ED 429 545 IR 019 453

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TITLE	The Internet in School: The Shaping of Use by Organizational, Structural, and Cultural Factors.
INSTITUTION	Pittsburgh Univ., PA. Learning Research and Development Center.
SPONS AGENCY	National Science Foundation, Arlington, VA.
PUB DATE	1997-11-00
NOTE	6p.; In: WebNet 97 World Conference of the WWW, Internet & Intranet Proceedings (2nd, Toronto, Canada, November 1-5, 1997); see IR 019 434.
CONTRACT	RED-9253452
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Access to Information; Asbestos; *Classroom Environment; Computer Uses in Education; Cooperative Programs; Educational Development; *Educational Facilities; Educational Technology; Elementary Secondary Education; *Internet; Problems; Qualitative Research; *School Administration; *School Culture; School Districts; Urban Areas; Use Studies
IDENTIFIERS	*Barriers to Implementation; Connectivity; Infrastructure; Pittsburgh School District PA; Technology Implementation; *Technology Utilization

ABSTRACT

Based on a four-year study of the Common Knowledge: Pittsburgh (Pennsylvania) project--one of four national "testbeds" for the exploration of the Internet's potential for improving education, this paper explores the factors that delayed, shaped, and constrained Internet use in a large urban school district. Although a substantial amount of use occurred, problems in interfacing with the district's pre-existing physical infrastructure, its bureaucratic procedures, and the culture of its schools all influenced use markedly. Infrastructure problems included difficulties retrofitting old buildings, including asbestos in school walls, and lack of needed power outlets, space, and furniture. Bureaucratic problems included incompatibility between rigid bell schedules and the unpredictability of access to Internet sites. Finally, cultural factors including the teachers' role as dispenser of knowledge, the image of a well-run classroom as one in which students sit quietly in their seats, the tendency to emphasize basic skills and to conceptualize learning along disciplinary lines, and concerns about ensuring that the materials students access in school are consistent with community beliefs and standards also shaped and limited Internet use. Contains 10 references. (Author/AEF)

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The Internet in School: The Shaping of Use by Organizational, Structural, and Cultural Factors

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Abstract: This paper explores the factors that delayed, shaped, and constrained Internet use in a large urban school district. Although a substantial amount of use occurred, problems in interfacing with the district's pre-existing physical infrastructure, its bureaucratic procedures, and the culture of its schools all influenced use markedly. Infrastructure problems included difficulties retrofitting old buildings, including asbestos in school walls, and lack of needed power outlets, space, and furniture. Bureaucratic problems included incompatibility between the rigid bell schedule and the unpredictability of access to Internet sites. Finally, cultural factors including the teachers' role as dispenser of knowledge, the image of a well-run classroom as one in which students sit quietly in their seats, the tendency to emphasize basic skills and to conceptualize learning along disciplinary lines, and concerns about ensuring that the materials students access in school are consistent with community beliefs and standards also shaped and limited Internet use.

In recent years calls to connect schools to the Internet have been legion. As just one example, President Clinton has made access to the Internet for all 12-year-olds one of the standard goals he has set for schools in the U.S. Those advocating Internet access point out a wide range of possible benefits [Hunter 1992]. Yet previous research demonstrates that the mere fact that teachers have access to computers does not mean that they will use them [Cuban 1986; Schofield 1994]. In addition, the computer use that does occur is often very much influenced by the existing school environment [Cohen 1987; Schofield 1995]. Building on such insights, this paper focuses on the ways in which existing school culture and structure can delay, constrain, and shape Internet use.

The paper is based on a four year study of a National Science Foundation funded project called Common Knowledge: Pittsburgh (CK:P) -- one of four endeavors in the United States designed to serve as national "testbeds" for the exploration of the Internet's potential for improving education. CK:P's goal, at the most general level, has been to bring Internet access to teachers in the Pittsburgh Public Schools for their use as a professional development resource, and, even more importantly, for instructional purposes. Before turning to the discussion of the results of this research, we will briefly describe both CK:P and the methodology used in gathering and analyzing the data upon which this paper is based.

Common Knowledge: Pittsburgh

CK:P is a collaboration between the Pittsburgh Public Schools, Pittsburgh Supercomputing Center, and the

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University of Pittsburgh. Over the past four years, CK:P has provided teachers and students in more than 60 schools with Internet access. The project has been based on the idea that teachers are the ones most suited to discover and develop the curricular uses that fit their students' needs. Thus, teachers throughout the district have been encouraged to join together with others at their schools into groups to develop proposals to submit to annual competitions which CK:P ran to select the classrooms for which it would provide Internet access. Many of the individuals participating in these groups, particularly in the first years of the project, had little, if any, experience with computers in general, or the Internet in particular. Thus, the CK:P staff provided a great deal of training and support regarding both technical and curriculum issues.

Methodology

The major data-gathering methods relevant to the issues discussed in this paper were qualitative observations, semi-structured interviews, and the collection of archival material. Since the project began in 1993, we have conducted extended and repeated observations in a wide variety of settings. This includes over 160 hours of observations in over 40 classrooms in which the Internet was being used. It also includes observations of over 125 meetings between different groups of teachers who have been involved with the project, and dozens of meetings of CK:P's educational and technical support staff. Trained observers used the "full field note" method of data collection [Olsen 1976] which involves taking extensive hand-written notes during the events being observed. All notes were made as factual and as concretely descriptive as possible.

Because interviews are so useful in providing participants' perspectives on events, over 350 semi-structured open-ended interviews were conducted with a very wide variety of individuals. This included over 100 teachers, 30 school district personnel, and 14 CK:P staff who supplied a great deal of data pertinent to the issues discussed here. All field notes and interviews were audiotaped, transcribed, and then coded using established qualitative methods [Strauss & Corbin 1990; Miles & Huberman 1994].

Archival materials, especially e-mail, were another important source of information used in this research. With the participants' permission, the research team's address was added to virtually all group mailing lists connected with the project. This allowed us to monitor most normal e-mail correspondence between members of the various groups working on this project.

Other more quantitative data were also collected when they appeared to be particularly useful. So, for example, certain kinds of usage statistics were collected from school-based file servers and surveys of teachers were conducted.

Results and Conclusions

There is no doubt that a substantial amount of Internet use occurred in the schools involved in the CK:P project. By the end of the project's fourth year, over 4,500 teachers and students had Internet accounts through CK:P. The kinds of activities that individuals engaged in were extraordinarily varied. A sense of the range and kind of usage was captured one day roughly three years into the project when participants from around the district were asked take a few minutes to let others know what they had used the Internet for that day. A collection of contributions from over 20 locations around the district created a snapshot of the kinds of CK:P activities occurring. Although it is likely that Internet activity was unusually high on this day, the kinds of activities in which people engaged seemed quite representative of the range of activities routinely observed in the schools.

High school students in French and German classes searched for information on Paris, Quebec, and Vienna using World Wide Web sites located in those countries. Students in Spanish classes communicated with individuals in Chili over Internet Relay Chat. Students from a variety of classes reported accessing sites containing career and scholarship related information. Middle school students reported having engaged in activities such as writing to

pen pals in Brazil, gathering information for reports on topics ranging from sports, to World War II, to eating disorders, and posting their own poetry for feedback on this day or earlier in the year. Elementary school children engaged in activities including work on logic projects obtained from an Internet site, visiting a virtual classroom in which they read stories and posted responses, checking weather forecasts, looking at interactive on-line maps of the city to find their own street corners, and corresponding with other elementary school classrooms to get information about two artists they were studying.

However, there was also no doubt that the level of Internet usage was constrained and that the nature of Internet usage was shaped in ways that were not always consistent with visionarys' images of the Internet's functioning in classrooms or with the participants' initial plans and hopes for it. We now turn to discussing how and why this happened, starting with a brief mention of the delays and constraints that arose from working within the physical infrastructure of a large urban school district. However, the primary focus of our paper is on the organizational and social factors that delayed, shaped, and limited Internet use.

Interfacing with the Existing Infrastructure

It became evident during the course of CK:P that providing schools with workable access to the Internet was often more difficult than anticipated. As has become apparent in "Netday" activities around the country, asbestos in walls can pose a major problem. At some CK:P sites asbestos caused substantial delays. At such schools the wiring was postponed for months in order not to expose students and teachers to it. Furthermore, the layout of some buildings made it prohibitively expensive to provide high speed connectivity in the desired places. Thus, in some cases, initial plans to put certain schools on-line so that teachers and students there could readily interact with each other around a shared curricular focus were changed in ways that reflected financial and infrastructure considerations rather than educational ones. The fact that decisions about the physical location of the drops necessary to connect computers to the Internet had to be made before teachers had much experience with using computers in their classrooms also created problems and inefficiencies. Finally, pre-existing electrical outlets, telephone lines, space, and even furniture were frequently not adequate for optional use of the new computers that project schools hoped to connect to the Internet. But the fact that money was tight meant that more often than not project teachers had to work within the constraints imposed by such factors which limited Internet use.

Interfacing with the Bureaucratic Structure Beyond the Classroom

A whole range of issues that delayed and inhibited Internet use were connected to the fact that teams of teachers working with CK:P were embedded in a larger structure with its own rules and operating procedures. Some problems of this sort were exacerbated by the fact that CK:P was a grassroots project funded from outside of the district, rather than being part of the district's own set of programs. However, many would most likely have created problems and delays in any event. Problems arising in interfacing with the district bureaucracy were extremely varied in nature. To give just one example, longstanding purchasing procedures required that purchases be made from the lowest bidder meeting the specifications laid out by the district. Thus, in one instance, computers were purchased from the lowest bidder even though the machines offered for a slightly higher price by another vendor had much greater potential for subsequent inexpensive upgrades that were likely to significantly extend to the machines' useful life. Although this did not cause an immediate problem, given the rapidity with which hardware changes and the ever increasing demands for memory, it seemed likely to curtail use in the long run.

One factor that appeared to play a major role in inhibiting Internet use was the rather rigid bell schedule which shaped teachers' and students' days. The fact that students were to study a particular topic at a particular time, at least in middle and high school, meant that they could not switch flexibly to other subjects if an Internet site they were trying to access for work in one subject was too busy to allow them access. Although students could, of course, try again the next day, the possibility that on any given day access would be either impossible or impractically slow meant that teachers needed to prepare alternative plans in case Internet activities did not

proceed as intended, something which was potentially quite time consuming and thus was unappealing to them.

Internet use was also greatly effected by the attitudes and behaviors of the principals at the school level. In some cases principals were very proactive in trying to create conditions conducive to productive use, providing time and other resources to the CK:P teams. In many other cases, however, competing priorities meant that decisions made at the building level undermined Internet use. For example, at one site a project selected for study as an "exemplary" use of the Internet came to a near complete halt when a new principal arrived and assigned one of the prime movers responsible for this project to hall duty during a period she had previously used for Internet activities. At another site, the principal required the adjusting of a school home page created by teachers and students so that no one outside of the school could access it, because she was concerned about the damage that could be done if materials of which she did not approve were placed there for all the world to see.

Interfacing with the Structure and Culture of the Classroom

Teachers not only function inside of a physical and bureaucratic environment, but they are also part of an on-going culture [Lortie 1975; Sarason 1971]. A number of aspects of traditional classroom structure and culture also appeared to inhibit students' classroom use of the Internet.

The teachers' role as a dispenser of knowledge, upon which much of the basis for the teachers' authority rests, is one important aspect of traditional classroom culture. It was not infrequent in middle school or high school for teachers to discover that at least one or two of their students knew more than they did about the use of the computers and the Internet. Some teachers adjusted to this quite readily and, in fact, found ways to take advantage of it. However, many were made anxious by the situation. Not infrequently, this resulted in decreased use on their part.

Closely connected to the image of teacher as a knowledge dispenser is the traditional image of the well-run classroom as one in which students sit quietly in their seats and listen attentively to the teacher who speaks to them as a group. Because resources were limited, teachers proposing projects to CK:P knew that they could only ask for a few computers per participating classroom. The small number of computers per class meant that many teachers had to find ways to adjust their approach to instruction, unless the computers were to sit idle the vast majority of the time. Many found this transition rather difficult, not only because they had to find ways to make sure that students using the computers at any given moment did not miss material they were later expected to know, but also because use of the computers tended to lead to more movement and noise in the classroom as students went from their seats to the machines and helped each other when confronted with technical problems. Such problems limited Internet use most noticeably in classrooms in which the teachers had little interest in or experience with small group approaches such as learning stations or cooperative learning groups.

Traditional images of what counts as learning that emphasize basic skills and conceptualize students' knowledge along disciplinary lines also shaped Internet use significantly. Traditional curricular materials such as textbooks are organized by discipline and present information in concentrated and highly organized ways designed specifically for students at given grade levels. This is generally not the case with materials found on the Internet. Concerned about efficiency and about ensuring that students did not miss out on important material they would later be expected to know, teachers sometimes treated Internet activities as optional enrichment projects to be used to fill up empty time slots or to be reserved exclusively for those who had already mastered the traditional curriculum.

Much has been written about the isolation of teachers and the importance of reducing it [Lortie 1975]. Although many teachers involved in CK:P actively reached out to others beyond their schools for professional discussions, strong norms relating to the privacy of a teacher's classroom still persisted and undercut Internet use. Specifically, if a class was not using the Internet during a period, as was frequently the case even in high use environments, teachers from another room almost never asked to have access to the machine -- even when there were interested teachers in the school who could have worked quietly by themselves and not disrupted the class in any obvious way. Since there were very limited numbers of computers with Internet access in many CK:P

sites, and a great many of them were in individual classrooms, this situation undercut use substantially.

Finally, teachers are well aware of the potential disruption and controversy that can arise if students are presented in school with material that their parents find objectional. Most are used to working in an environment which includes often elaborate procedures to approve textbooks and other curriculum materials. Internet use poses a problem in this regard since it is possible for students to access materials that would never pass such procedures or to strike up acquaintances with individuals who may wish to exploit them in some way. CK:P, like most Internet projects, had both parents and students sign an "acceptable use" policy which indicated that a wide variety of materials were available and delineated the kinds of uses that students could legitimately make of the Internet. In spite of this, classroom use of the Internet was greatly reduced in many instances because of teachers' concerns about the potential for students violating this policy, which led them to allow use only when an adult could directly view the computer monitor.

In summary, although much constructive use was made of the Internet in schools participating in CK:P, such use was substantially delayed, limited, and shaped in unanticipated ways by problems created by organizational, structural, and cultural factors. To achieve the full potential of Internet use in the schools, these factors will have to be addressed at the district, school, and classroom level.

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Acknowledgments

The research reported here was funded by Contract No. RED-9253452 with the National Science Foundation. All opinions expressed herein are solely those of the authors and no endorsement of the conclusions by the National Science Foundation is implied or intended.